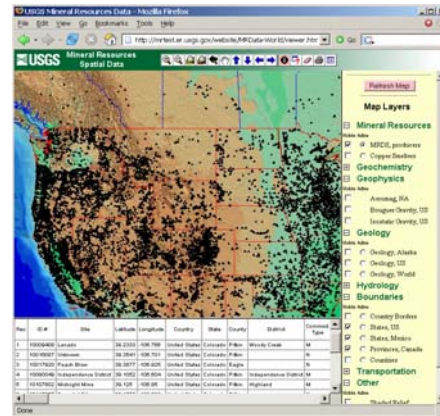


## FY 2005 Program Performance Accomplishments

**Easy Access to Internet-Based Mineral Resource Data**—Consistent, seamless Internet-based databases of the U.S. are important tools for land-use planners and a wide variety of researchers because they provide a way to rapidly respond to the need for information on a regional scale; because they provide reliable information based on consistent data standards; and because they provide live access to frequently updated databases. The Mineral Resources Program (MRP) supports an on-going effort to coordinate the development of national-scale geologic, geochemical, geophysical, and mineral resource databases and the migration of existing databases to standard models and formats that are available to both internal and external users. In FY 2005, MRP's Spatial Data Delivery project finished implementing new client web mapping software which allows users to combine minerals data with

data from other web sites, as well as their own data, into a single map. A new user interface was added to the web site to permit users to download portions of geographic and/or thematic datasets that are tailored for their specific needs. So now, for example, land-use data from a land-management agency may be combined with geochemical or mineralogical data from MRP to create a map to meet the user's specific needs. The public web site, available at <http://mrdata.usgs.gov>, now serves more than 40 national and/or global geoscience data themes in addition to various base data layers. In FY 2005, the web site served more than 275 unique users/day from more than 75 countries worldwide. The web site averaged more than 50,000 hits/week and was available 99% of the time. This work fulfills a PART (Program Assessment Rating Tool) milestone for MRP to develop, upgrade, and maintain web-based, data delivery system for geochemical, geophysical, mineral deposit, and lithologic data.

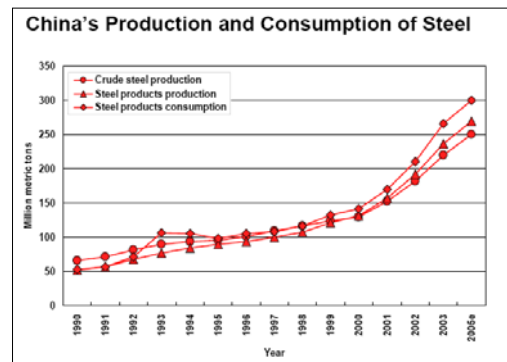


The public website's updated opening web page for Mineral Resources Program spatial data available at:  
<http://mrdata.usgs.gov>.

**New Techniques for Identifying World Class Ore Deposits**—Mineral Resources Program (MRP) scientists have discovered that strontium isotopes can be important indicators of world class ore deposits. Millions of years ago, metal- and nutrient-laden brines and petroleum were discharged from sedimentary rocks into marine basins at sea floor vents. The fluid discharge events were sometimes large enough to cause a global shift in the strontium isotopic signature of the ocean, making it possible for scientists to chemically analyze fossils in drill core samples and identify when and where the strongest shifts occurred. These chemically distinct layers can be correlated with some of the world's largest deposits of lead, zinc, gold, manganese, nickel, molybdenum, and phosphorite. The use of strontium isotopes as an indicator of world class ore deposits has great potential as an exploration tool for undiscovered mineral deposits and is of particular interest to industry. The results of this research, completed in FY 2005, are identified as one of the systematic analyses delivered to customers, an output defined in

performance measures for MRP. In FY 2006, results of this research will be applied to the refinement of mineral deposit models that are used to reduce the level of uncertainty in mineral resource assessments; this work contributes to the long-term MRP goal of conducting research targeted at reducing uncertainty in geoenvironmental models and assessments. Future work will also investigate the role of these fluid expulsion events on global ocean chemistry, ancient ecosystems, and climate change.

**Impact of China on the Economy: Use of Minerals Information**—In FY 2005, a presentation by scientists supported by the Mineral Resources Program (MRP) at the Mineral Economics and Management Society in Washington, D.C. demonstrated that continued strong economic growth in China and other developing countries with large populations has important implications for the economy and national security of the United States. Rapid growth in developing countries is greatly increasing global mineral consumption, changing global patterns of mineral production and trade, and increasing releases to the environment. As a result, reliable information is more important than ever for economic and national security planning, and for development of public policy. Continued growth of the economies of China, India, and other developing countries could result in a period of rising prices for mineral commodities. A pattern of rising prices contrasts with the trend of the last 30 years, during which the prices of many minerals declined. Over the next 20 years, mineral commodity price trends may more closely resemble the period from 1950 to 1970, when a larger proportion of the world's economies were undergoing development. Preliminary information about this important topic was released in November 2004 and is available at <http://pubs.usgs.gov/of/2004/1374/>. Work on this topic will continue in FY 2006 as part of a long-term goal of MRP to provide timely and authoritative data and analyses of the minerals cycle, issues related to sustainable development, and materials flow to private and government decision makers and the public.



Graph showing China's production and consumption of steel, 1990-2005. In 2005, China's crude steel production is estimated to be more than the United States and Japan's crude steel production combined and at the same time China is importing both crude steel and steel products. The rapid increase in steel production and consumption, beginning in 2000, marks the beginning of the heavy manufacturing stage. Data for 2005 estimated. (From Menzie and others, USGS Open-File Report 2004-1374.)

**Interagency Team Assesses Environmental Damage Near Large Copper Mine on Marinduque Island, Philippines**—At the request of the Republic of the Philippines, USGS scientists led an interagency team from the United States to assess mining-related environmental problems, including potential health effects and mine safety issues, at

Marinduque Island, Philippines in FY 2005. Over several decades, open-pit copper mining at two different sites has resulted in the release of large volumes of tailings, mine wastes, and acid mine waters into rivers and nearshore marine environments. By collecting new data on water quality, soil and tailings chemistry, and aquatic ecology, team scientists were able to prioritize the mining-related issues that posed the greatest risk to public safety, the environment, and human health. They were also able to assess the relative strengths and weaknesses of potential remedial options. The available data suggest that a variety of human health problems (such as elevated levels of lead in blood) in some island residents cannot conclusively be linked to the mining activities, as previously believed. The team provided recommendations for further environmental monitoring and extensive health assessment studies needed to more accurately understand the extent and nature of mining-related impacts on the environment and human health. In FY 2006, a USGS team is scheduled to travel to the Philippines, again at the request of the Republic of the Philippines, to develop a work plan for integrating existing geologic data and maps of the entire country in a digital format in preparation for a state-of-the-art mineral resource assessment. The work is being coordinated by the U.S. Agency for International Development.



Photographic panorama showing erosion of mine waste dumps into the lower Makulapnit siltation impoundment. Digital composite of three photographs by H. Miller, J Madsen, taken in June 2003.

**Nickel Deposits Identified in Alaska Based on USGS-BLM Collaboration**—Mineral Resource Program (MRP) scientists have investigated the mineral potential of the Nikolai flood basalt province, a 230 million-year-old feature in the central Alaska Range. Geologic and geophysical methods were used to investigate controls on the Fish Lakes/Tangle Lakes area, which appears to have been one of the main vent sites for volcanism that produced the flood basalts. Recent studies by the USGS and BLM have defined a zone of potential mineralization more than 10 miles in length. Based on these findings, along with detailed mapping and geochemical data from industry and the State of Alaska, industry has developed models indicating that the identified zone may be a primary target for significant deposits of nickel, platinum-group elements, and gold. The

results of this research were identified as one of the systematic analyses delivered to customers in FY 2005, an output defined in performance measures for MRP.

**Mineral Resources Research Provides Tools for Evaluating Impact of Hurricanes Katrina and Rita along the Gulf Coast**—Hurricane Katrina made landfall along the central Gulf Coast on August 29, 2005 and before the region had begun to recover, Hurricane Rita arrived one month later. In the aftermath of these storms, analytical and remote sensing capabilities of the Mineral Resources Program (MRP) were used to provide data critical for understanding the impact of the storms on sediments and water in the devastated region. In FY 2005, as part of a bureau-wide effort, MRP scientists conducted geochemical analyses to characterize the makeup of sediment samples. Microbial and isotopic analyses were also initiated; these analyses will be helpful in identifying potential health issues and water and wind patterns associated with the storms, respectively. Preliminary results have been provided to the Environmental Protection Agency, the Louisiana Department of Environmental Quality, and other agencies involved in making health and safety decisions related to the return of residents to flooded areas. In addition, MRP scientists collected data on sediments and water through use of an airborne remote sensing technique called the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). In combination with analyses of samples collected on the ground, spectral data from this technique are used to identify minerals and suites of minerals in the devastated area. Preliminary results indicate that a high concentration of pyrite is present in the sediments, and that there is potential for acidic drainage problems similar to those found in some abandoned mines. When sediments deposited in some of the flooded areas are dried and can be removed, their disposition may require special consideration to prevent acidic drainage. In FY 2006, it is anticipated that MRP research will continue to contribute to the understanding of the long-term effects of the storms. This work demonstrates how techniques and expertise needed to support the long-range goal of MRP to ensure availability of up-to-date environmental assessments of priority Federal lands benefits a wide range of U.S. citizens.

**BOR, EPA, NIST Rely on Minerals Analytical Expertise**—Geochemical analyses have proved to be an invaluable tool in the study of various earth science, ecological, and biological processes and features. The success of a wide range of work for other agencies depends upon the availability of modern, rapid, multi-element analytical instruments and techniques. In FY 2005, USGS scientists provided geochemical analyses of sediments to the Bureau of Reclamation's Grassland Bypass Project, a project developed to improve water quality in wildlife refuges and wetlands in central California, sustain the productivity of 97,000 acres of farmland, and foster cooperation between area farmers and regulatory agencies in drainage management reduction of selenium and salt loading. Another important activity that depends on USGS geochemical research is the development of Standard Reference Materials (SRMs) for the National Institute of Standards and Technology (NIST). In FY 2005, Dr. Stephen Wise, Chief of the Analytical Chemistry Division at NIST, wrote that "the partnership between USGS and NIST ... plays a critical role in the development of SRMs of environmental significance. .... It would be difficult and costly ... to find a new source for the unique combination of capabilities, expertise, and services provided by the USGS." USGS geochemists also

provided analyses of water pipe samples from a number of sites in the eastern United States for the Environmental Protection Agency (EPA); these analyses are currently being evaluated to test their utility in potable water systems and industrial applications. This work will continue in FY 2006.

**USGS Stream-Sediment Geochemistry Used to Monitor Remedial Actions in Coeur d'Alene Mining District, Idaho**—In recently completed watershed-characterization studies, USGS scientists demonstrated that historical mining for silver-lead-zinc ore has resulted in streambed sediments that are enriched with lead, zinc, mercury, arsenic, cadmium, silver, copper, and cobalt in tributaries of the North Fork of the Coeur d'Alene River, Idaho. One of these studies, completed in cooperation with the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM), concluded that lead and zinc occur at 20-100 times the normal background levels in the vicinity of the historic mine and mill sites (USGS Scientific Investigations Report 2004-5284). The baseline data provided by the USGS are being used by the USFS and BLM to monitor concentrations of metals in streambed sediments that are targets for remedial actions underway at several mine and mill sites in the drainage basin. In another study, conducted in cooperation with the Coeur d'Alene Tribe, USGS scientists reported that although mill tailings have not been discarded directly into tributary streams since 1968, they continue to be a problem because frequent floods remobilize large sources of metal-enriched sediment derived from mill tailings that are now in and adjacent to the river. As a result, lead-rich sediments continue to be deposited on the flood plain (U.S. Geological Survey Open-File Report 2004-1211). The National Research Council (NRC) of the National Academy of Sciences recently used information from this report to evaluate remedial options proposed by the Environmental Protection Agency (EPA) for the Coeur d'Alene River valley. In 2005, NRC reported that the information supplied in Open-File Report 2004-1211 “greatly advances the understanding of sediment transport and fate in the lower basin and should serve as an excellent guide for EPA in the remedial design process” (<http://www.nap.edu/books/0309097142/html/R1.html>). This work supports the Mineral Resources Program goal of providing objective information and analysis related to minerals issues to support those who make decisions regarding national security, land use, resource policy, and environmental or public health and safety.

**Mineral Resource Assessment Integrated into BLM Regional Management Plan Revision in Nevada**—USGS scientists recently completed a comprehensive mineral-resource assessment of the Humboldt River Basin in northern Nevada, an area that hosts one of the Nation's most important sources of gold, silver, copper, mercury, and tungsten. The assessment, requested by the Bureau of Land Management (BLM), is focused on an area having a variety of land-use issues related to mining, conservation, and concern for the environment. USGS Bulletin 2218 identifies large areas in the Humboldt River Basin that may contain undiscovered metallic mineral deposits and that may be sites for future mining activities. In a recent letter to the USGS from BLM representatives, the digital, GIS-based assessment maps produced by this project were identified as data layers that can be combined with other GIS data needed for land-use planning; this will enable the BLM to include minerals-related information in future evaluations of multiple-use public lands. BLM states “the USGS mineral assessment is greatly appreciated and will be of



immediate and long-term use and benefit for both regional and field office planning purposes.” To ensure that the needs of the BLM were met, USGS scientists met four times with State and District BLM managers in Reno, Winnemucca, and Elko in 2005; these meetings provided guidance to BLM on how best to use the report and accompanying digital assessment maps. USGS scientists gave presentations on the methodology and results of the assessment; these presentations were followed by more in-depth discussions of the strengths of the maps and specific applications. USGS scientists will continue to provide background information and support to BLM as needed. This work supports the Mineral Resources Program goal of providing objective information and analysis related to minerals issues to support those who make decisions regarding national security, land use, resource policy, and environmental or public health and safety.

**USGS Scientists Assist State Department in Kimberley Process Review**—The Kimberley Process is a joint initiative developed by representatives from government, international diamond industry, and civil society to stem the flow of conflict diamonds, that is, rough diamonds used by rebel movements to finance wars against legitimate governments. In 2005, at the request of the U.S. Department of State, the Mineral Resources Program provided technical representatives to Kimberley Process Certification System (KPCS) international expert teams in Guinea, Liberia, Sierra Leone, and Russia. The KPCS teams reviewed compliance with, or the ability to establish compliance systems for, rough diamond export standards in Africa and Russia. USGS minerals information specialists provided data on imports, exports, and other trade issues critical to the review process. Statistical analyses of data generated by the Kimberly Process also were provided by USGS specialists. In addition, in 2005 the reviews for the European Union, Angola, and Namibia were completed. Work on this topic will continue in FY 2006 as part of a long-term goal of MRP to provide timely and authoritative data and information, including data on production, trade, and industry structure, on industrial minerals, international minerals, and metals to Government and private decision makers and the public.

**USGS Partners with AGI to Publish Popular Resource: *Aggregates and the Environment***—USGS scientists worked cooperatively with the American Geologic Institute (AGI) to produce *Aggregates and the Environment*, an AGI publication that provides information on the main types of natural aggregate (sand, gravel, and crushed stone) essential for use in construction. Today aggregate production accounts for about half of the non-fuel mining in the U.S., and it is of major importance in building and maintaining roads, rail lines, bridges, airports, seaports, hospitals, schools, factories, and homes. But the mining and processing of aggregates also raises concerns about potential environmental impacts. The new AGI publication provides a balanced discussion of these topics, and it has been well received by States, industry, and the general public. In written correspondence, the Missouri Geological Survey and Assessment Division, Missouri Department of Natural Resources, stated that this publication “provides an attractive, understandable and unbiased explanation of how aggregate development occurs...” The Granite Construction Companies of Utah stated that “this publication is a great resource to use while explaining the crushing process, why aggregates are so

important, who is using them, and how much is being used.” This work supports the Mineral Resources Program (MRP) goal to provide objective information and analysis related to minerals issues to support those who make decisions regarding national security, land use, resource policy, and environmental or public health and safety.